THE

Malayan Agricultural Journal.

JANUARY, 1940

EDITORIAL.

Pig Keeping in Malaya.

The flesh of the pig constitutes almost exclusively the meat portion of the diet of the Chinese in Malaya, who, numbering in excess of 2¼ millions, constitute some 42 per cent. of the population of this country. Pig keeping is thus of considerable economic importance, and although the imports of live pigs into this country have shown a steady tendency to decline during the past decade, there is still room for expansion of the local pig-keeping industry. An article in this number shows how improvement can be effected and deals with all important aspects of pig rearing under local conditions.

The author, Mr. T. D. Marsh, first discusses the taxonomic relationships of pigs in general and then proceeds to a consideration of the growth and other noteworthy characteristics of the local Chinese pig. He shows that while sows of this type make excellent mothers, their progeny, when sired by a boar of the same breed, leave much to be desired in the matter of growth rate in the early stages and consequently, also, in respect of the time taken to attain marketable maturity. While the Chinese pig is undoubtedly susceptible to improvement by better feeding—both in respect of growth rate and type of carcase produced—even greater gains in both respects can be secured by a combination of better feeding and cross-breeding.

The practice of mating pure-bred European-type boars with local Chinese sows has accordingly become increasingly popular during the past few years, and the resultant cross-bred progeny when adequately fed have been found to possess very good growth characteristics and to form carcases which are suitable for present market requirements. The trend of demand is now in favour of a leaner type of pork than was popular in this country in the past.

The natural complement to better breeding is adequate feeding and after a practical exposition of the former in some detail the author proceeds to a consideration of feeding in all its important aspects. He first describes the supplementary feeding of suckling pigs and then gives balanced rations for all ages of stock. These rations are compounded from locally-produced constituents and their preparation and method of feeding are adequately described. The author next proceeds to a consideration of the individual constituents of the rations and concludes with sections on housing, water supply and disease.

Tung Oil.

Tung oil, frequently referred to as Chinese wood oil on account of its extensive production in south-eastern China, is classified technically as a drying oil. It is accordingly in considerable demand in the paint and varnish industries, particularly since after suitable heat treatment the oil dries with a somewhat tough and yet elastic surface, thereby enhancing the waterproofing properties of the paint or varnish which contains it.

Consonant with the policy of similar organizations in other colonial administrations, this Department has, among numerous other potential local crops, investigated the possibilities of tung oil cultivation. The commercial oil as exported from China is obtained from two species of the same genus—*Aleurites Fordii* and *Aleurites montana*—and early experiments soon indicated that neither of these two species was suitable for cultivation on the lowlands in Malaya. Efforts were therefore made to grow the crop at Cameron Highlands and an article in this number indicates that a similar disappointing conclusion also has been reached in respect of upland cultivation in this country.

The two species were planted out on the Tanah Rata Agricultural Station, Cameron Highlands, and on account of the extremely poor early growth of *A. Fordii* it soon became evident that *A. montana* was the only species likely to succeed. Growth of this species was satisfactory, but characteristics which developed later, such as irregular wintering, flowering and fruiting periods, indicated that the tree is not really suited even to Malayan upland conditions. Yields of fruit, though higher than those obtained on the plains, never reached an economic level, and expert reports showed that the oil from this species was technically inferior to the oil from *A. Fordii* and consequently also inferior to the commercial Chinese wood oil, since the latter is usually a mixture of oils from the two species. It would appear, therefore, that, in spite of the ease with which a high quality oil can be prepared, the low yields and other negatory characteristics of the trees will prevent this crop from attaining a permanent place in Malayan agriculture.

Orginal Articles.

PIG KEEPING IN MALAYA

BY

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Introductory.

Pigs collectively comprise the family Suidae, *Sus* being the chief genus.

Sus is widely distributed throughout Europe and Asia and consists of closely allied species, several of which seem, at various times, to have been domesticated.

The European domestic pig came originally from the wild boar of Europe, *S. scrofa*. In India a domestic pig was obtained from the wild *S. cristatus*. The European breeds have been much crossed by the Indian pig so that none of the better modern races are pure. The principal aim in breeding has been to supply carcases to suit the particular requirements of markets.

The Indian wild pig, *S. cristatus*, penetrated into Malaya and was common in Singapore where it used to be allowed to breed with domestic sows(1).

As a result of religious scruples which prevented those who adopted Mohammedanism from having anything to do with the animals, pig-keeping in Malaya is now practically entirely in the hands of the Chinese, with the result that the domesticated pig is usually referred to as the Chinese pig.

Chinese Breeds in Malaya.

The common Chinese pigs in Malaya are the black or porker type and the grey and white piebald type. The latter resembles the bacon and ham producing class of animal of Europe.(2 & 3)

Sows of both Chinese types are noted for their fertility and good milking characteristics; they are regarded as excellent mothers, but Chinese weaner pigs, even though the sows are fed on adequate rations, are only about one-half the weight of weaners of European breeds. The age at which the piglings are weaned varies from 8 to 10 weeks.

This slow start in gaining weight causes the Chinese pigs to be late in reaching killing weights compared with those of English breeds.(4) In addition, the feeding methods adopted by Chinese breeders, using bulky vegetable foods supplemented by a meagre ration of concentrates, do not encourage a rapid live-weight gain per day.

These facts were further demonstrated in a trial conducted during 1938 at the Central Experiment Station, Serdang. A litter of pigs raised on a Chinese small holding was divided into two. One-half of the litter was transferred to Serdang and fed on balanced rations; the remainder of the litter was kept by the breeder, who used a typical small-holder's ration.

A comparison with the half litter retained by the Chinese breeder showed that the pigs at Serdang put on weight at double the rate of those on the small holding.

A comparison with English breeds of pigs at Serdang showed that the Chinese pig was about 4 months old before its weight approximated to that of a weaner pig of an English breed. When fed on identical rations, both the 4 months old Chinese pigs and the English weaners made similar live-weight gains until killing weights were reached, but at this stage the Chinese pigs were between $1\frac{1}{2}$ and 2 months older than the English pigs.

The method of using bulky vegetable foods supplemented by a meagre ration of concentrates tends to produce a fat carcase of soft pork. In the past the Chinese community has shown a preference for such meat, although there is now a growing demand for a firm carcase with more lean, except possibly in the case of pork for the labouring classes, who require more fat as a source of energy.

Cross-breeding in Malaya.

Cross-breeding with European breeds of pigs has rapidly gained popularity during the past few years; the cross-breds mature earlier and are more suitable for modern market requirements. Earlier maturity demands more liberal feeding, but over-all savings in feeding are made in having to supply rations for a shorter period.

During recent years the following breeds have been introduced and used with success in crossing with Chinese pigs: the Large and Middle White, Large Black and Berkshire (English), Landrace (Danish), and Poland China (American).

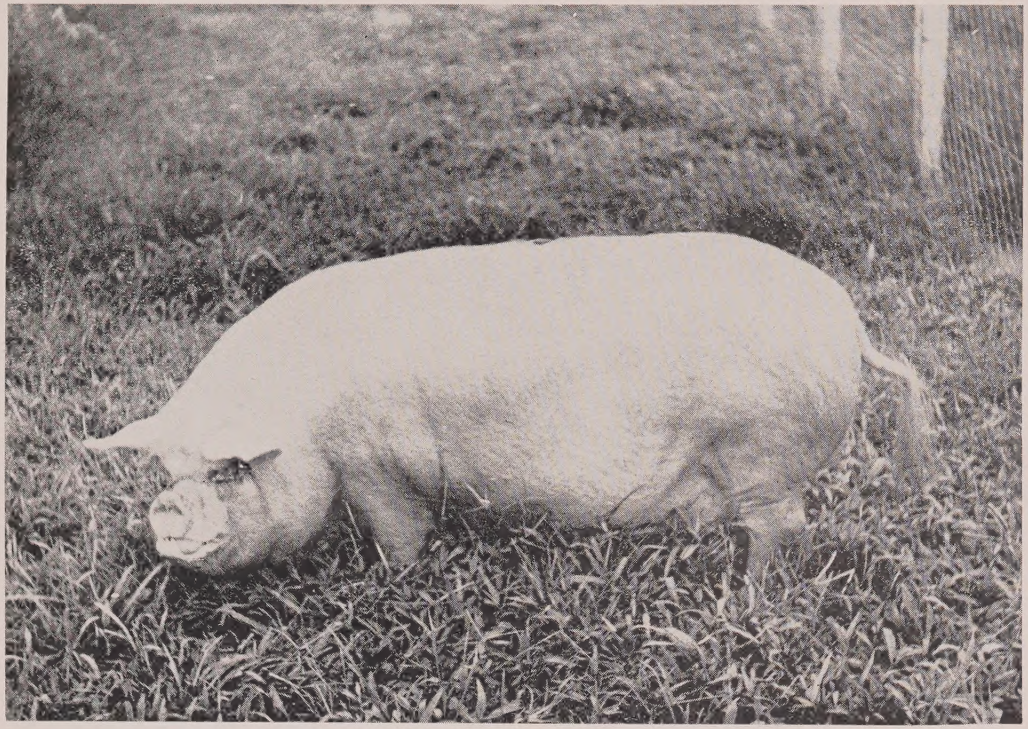
It is preferable to use boars of imported breeds to mate with Chinese sows, since the sows of European breeds do not in general milk so well on the lowlands in Malaya. Further, advantage can be taken of the fact that the boar is prepotent compared with the sow, *i.e.* he possesses a greater power of transmitting hereditary qualities. Conversely the use of Chinese boars mated to European sows is likely to breed animals closer in type to the Chinese than to the European breed.

One of the best methods of importing pigs to Malaya is in the form of pregnant sows, preferably carrying their second litter. In this way proved sows with a litter are imported at little more cost than a mature pig of either sex. Such importations should not be made during the period of the South-West Monsoon as the movement of the boat is liable to cause the sow to abort.

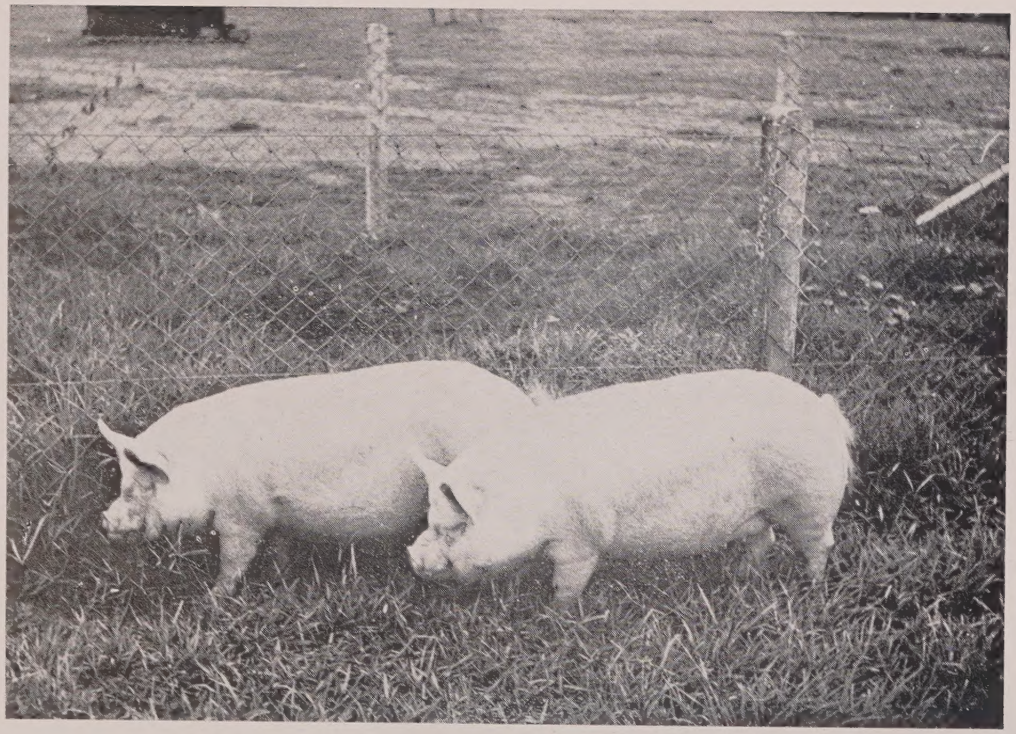
General Observations on Breeding.

Stud stock require to be maintained in an active store condition and allowed to have daily exercise. Access to clean running water in which they can take a bath as often as inclined is desirable or, alternatively, they should have water thrown over them by the attendants.

Vigorous well-grown weaners should be chosen for breeding purposes. It is preferable to select good weaners from sows that normally produce large litters rather than exceptionally well-grown pigs from a small litter farrowed by an unprolific sow.



Middle White Sow.



Middle White Gilts.

Animals selected for stud purposes should have the characteristics of their particular breed well defined and be devoid of physical defects. A long frame with well sprung ribs and deep wide hind quarters is desirable; the number of well-developed teats should be not less than twelve. Dome-shaped udders with inverted teats are a serious imperfection.

To encourage early maturity and to save upkeep costs, some breeders mate pigs at 8 months, but it is not wise to use animals of either sex for breeding until they are 9 months old. Alternatively the mating of gilts should not be delayed later than 10 months, since they are liable to become overfat and temporarily or even permanently sterile.

Castration of young boars which are not required for stud purposes is usually performed at the age of 3 to 4 weeks and before the animals are weaned.

The spaying of surplus weaner sows is practised, frequently by itinerant operators. The animals appear to suffer little shock or inconvenience considering the operation involves the opening of the abdomen. Further, as far as can be ascertained, there is a surprisingly low subsequent mortality among animals on which this operation is performed.

Since spayed animals retain their appetite continuously they increase in weight more rapidly than fully sexed sows. The latter become restless and go off their food during periods of oestrum.

Pregnant sows require plenty of exercise until the time of farrowing. A Chinese sow often has such a distended abdomen and pendulous udder that as the time of parturition approaches, the udder becomes so low that it is trailed on the ground, and in consequence the sow is incapable of taking exercise. This condition is associated with a ration containing an excess of water.

The ration must be adequate and, immediately after farrowing, of a laxative nature. The food should be increased as the demands of the litter for milk become greater so that the sow is not required to draw on her bodily reserves to maintain her milk supply. A simple rule when feeding sows in milk is to allow, per day, 2 lbs. of 'dry' rations (see page 9) for the sow and 1 lb. for each suckling pig.

It is advisable to house the sows in the breeding pens a few days before they are expected to farrow, so that they may become accustomed to their quarters.

A pen about 10 ft. x 10 ft. is large enough; farrowing rails set about 9 ins. from the floor and 9 ins. from the wall all round are desirable to prevent the sow from lying on her young during the days immediately after farrowing. A limited amount of dried grass cut into short lengths makes suitable bedding.

In addition to the ordinary methods of cleanliness necessary with farm animals at the time of parturition, it is advisable to paint the navels of young pigs at birth and the following day with tincture of iodine as a preventive against bacterial infection.

Washing the congested external parts of the sow's reproductive organs with a mild disinfectant discourages blowflies from laying eggs. In the event of these parts or the navels of newly-farrowed pigs becoming blown, iodoform powder or an antiseptic ointment, such as flowers of sulphur and lard or margosa oil, may be applied.

As stated previously suckling pigs are weaned at about 8 weeks of age. Two or three of the weakest pigs may be left with the sow for a further week or so; the weaning is then not such a shock to the sow and the extra milk available helps the backward pigs considerably.

Sows come into oestrum from 3 days to one week after the removal of the litter; since the period of gestation is 16 weeks, two litters may therefore be reared per annum. Such intensive reproduction needs, however, to be associated with liberal feeding and an adequate supply of minerals.

Feeding.

Arrangements to feed the young pigs from the time they are 5 to 6 weeks old are necessary and can be effected by the use of a creep in the farrowing pen, having uprights about 5 to 6 ins. apart through which the young pigs can pass to a trough of special food to which the mother is thus denied access.

Cereals, other than padi, and fresh dairy by-products, such as separated milk, buttermilk or whey, normally fed to pigs in England, are unprocurable in Malaya. Dried milk has recently been placed on the market but it is expensive and permits to purchase have to be obtained. Consequently a gruel substitute, known as soya bean milk, is fed to weaners by many Chinese pig-keepers. The gruel is prepared in the following manner. The fresh beans are soaked in water for 4 to 6 hours and then ground to a paste, usually in a hand-power stone grinder. This paste is mixed with warm water in the proportion of 2 lbs. of beans (dry) to each gallon of water, and the gruel resulting is warmed to blood heat and fed to the suckling pigs thrice daily.

Apart from the inequality in size of pigs in litters when they are born and the consequent uneven growth due to the inexorable law in nature of the "survival of the fittest", many young pigs suffer from apparent deficiency diseases, one of which in temperate climates is a form of anaemia. This usually responds to administrations of iron salts.

In trials at Serdang applications of iron in the form of iron (ferrous) sulphate mixed with molasses and painted daily on the udders of sows in milk did not apparently supply the deficiency to sub-normal suckling pigs.

Further investigations showed that the addition of small amounts of minced beef fat to the ration of weaned pigs which were so weak and emaciated that they would ordinarily have been destroyed had a remarkable effect on growth; the pigs rapidly became normal and subsequently made the usual live-weight increases. Red palm oil fed to another lot of pigs in the same experiments was found to have very little effect on the growth rate and evidently did not remedy the deficiency.

Middle White × Chinese Sow with Litter. Litter sired by Middle White Boar.

Chinese Sow with Litter. Litter sired by Middle White Boar.

After weaning at 8 to 10 weeks of age it is recommended that the soya bean gruel previously mentioned be gradually substituted by the ration detailed in Table I. Excellent live-weight increases have been obtained at Serdang using this ration which fulfils Kellner's requirements for 1,000 lbs. of pigs each weighing 44 lbs. (4, 5 & 6).

Table I.

Details of Daily Ration and Costs for Pigs 8 to 16 Weeks Old.

Constituent of Ration	Amount of Constituent	Price of Constituent per lb.*	Cost of Constituent (nearest cent)
	lbs.	cents	$
Fresh Food			
Sweet potato vines ...	10	0.40	0.04
Banana stems ...	10	0.40	0.04
Guinea grass ...	10	0.20	0.02
Total Fresh Food ...	30		
Concentrates and Minerals			
Broken rice ...	28	2.62	0.73
White rice polishings ...	3	1.72	0.05
Coconut cake (once pressed) ...	5	2.81	0.14
Groundnut cake ...	6	3.56	0.21
Red palm oil ...	0.5	7.00	0.04
Minerals ...	1	3.00	0.03
Total Concentrates and Minerals ...	43.5	Total Cost of Ration	$1.30

Reducing the weight of fresh foods, the constituents of which vary in moisture content from 77 to 95 per cent., to a 'dry' weight figure based on the average moisture content of the concentrates and minerals, the total quantity of 'dry' food fed daily amounts to 4.5 + 43.5 = 48.0 lbs. per 1,000 lbs. of pigs. This amount supplies 5.6 lbs. of digestible protein and 38.3 lbs. of starch equivalent.

* The figures given in this column are based on pre-war prices.

Allowing an average live-weight of 25 lbs. per animal, the 'dry food' consumed is 1.2 lbs. per animal per day, costing approximately 3.25 cents. It should be noted that cross-breds and Chinese pigs rarely exceed 25 lbs. live-weight when 10 weeks old.

When the animals are 16 weeks old the ration shown in Table II, which also fulfils Kellner's requirements, should be substituted for the above ration as being suited to the requirements of larger animals and for reasons of economy. The total amount of the daily ration is based on 1,000 lbs. live-weight of animals.

Table II.

Details of Daily Ration and Costs for Pigs 16 Weeks Old.

Constituent of Ration	Amount of Constituent	Price of Constituent per lb.*	Cost of Constituent (nearest cent)
	lbs.	cents	$
Fresh Food			
Tapioca roots ...	60	0.40	0.24
Concentrates and Minerals			
White rice polishings ...	6	1.72	0.10
Coconut cake (double pressed) ...	6	2.81	0.17
Groundnut cake ...	5	3.56	0.18
Red palm oil ...	0.5	7.00	0.04
Minerals ...	1	3.00	0.03
Total Concentrates and Minerals ...	18.5	Total Cost of Ration	$0.76

Reducing the weight of the fresh tapioca roots, the moisture content of which is approximately 65 per cent., to a 'dry' weight figure based on the average moisture content of the concentrates and minerals, the total quantity of 'dry' food fed daily amounts to 23.0 ÷ 18.5 = 41.5 lbs. per 1,000 lbs. of pigs. This amount supplies 3.9 lbs. of digestible protein and 33.0 lbs. of starch equivalent.

Allowing an average live-weight of 70 lbs. per animal, the 'dry' food consumed is approximately 2.9 lbs. per animal per day, costing about 5.31 cents. Pigs reared on the lowlands rarely exceed an average live-weight of 70 lbs. when 16 weeks old.

These rations may at first sight appear expensive but with proper management weaner cross-bred pigs weighing 25 lbs. when 8 to 10 weeks old if fed as indicated above should attain a live-weight of about 140 lbs. when 5½ to 6 months old.

* The figures given in this column are based on pre-war prices.

Table III gives details and costs of a suggested daily ration for mature breeding animals. The total amount of the ration is based on 1,000 lbs. live-weight of animals.

Table III.

Details of Daily Ration and Costs for Mature Breeding Pigs.

Constituent of Ration	Amount of Constituent	Price of Constituent per lb.*	Cost of Constituent (nearest cent)
	lbs.	cents	$
Fresh Food			
Tapioca roots ...	50	0.40	0.20
Guinea grass ...	10	0.20	0.02
Total Fresh Food ...	60		
Concentrates and Minerals			
White rice polishings ...	4	1.72	0.07
Coconut cake (double pressed) ...	3	2.81	0.08
Groundnut cake ...	2	3.56	0.07
Dried fish ...	2	0.02	0.04
Red palm oil ...	0.5	7.00	0.04
Minerals ...	0.5	3.00	0.02
Total Concentrates and Minerals ...	12.0	Total Cost of Ration	$0.54

Reducing the weight of fresh foods, the constituents of which vary in moisture content from 65 to 77 per cent., to a 'dry' weight figure based on the average moisture content of the concentrates and minerals, the total quantity of 'dry' food fed daily amounts to 22.0 + 12.0 lbs. = 34.0 lbs. per 1,000 lbs. of pigs. This amount supplies 2.5 lbs. of digestible protein and 24.5 lbs. of starch equivalent.

Allowing an average live-weight of 200 lbs. per animal, the 'dry' food consumed amounts to 6.8 lbs. per animal per day, costing approximately 11 cents.

It may be necessary at times for practical purposes to substitute other succulent foods for those specified in the different rations. In such cases the quantities of some of the other constituents may require adjustment so as to maintain a balanced ration.

* The figures given in this column are based on pre-war prices.

Fattening pigs of 42 lbs. live-weight will eat about 2 lbs. 'dry' food per head per day; at 70 lbs. they will need 3 lbs. After this a $\frac{1}{4}$ lb. increase in the daily ration should be allowed for each 7 lbs. gain in live-weight up to a maximum daily ration of about 6 lbs. for animals of 150 to 160 lbs. live-weight.

Feeding trials at Serdang have indicated that the rate of live-weight increase per unit weight of ration consumed is higher than in temperate climates(4). This is attributed to the smaller demand by the animals on account of the warm climate for the heat-producing ingredients of the ration with consequent utilization of the latter in increasing the body weight as distinct from maintaining the normal body temperature. The results suggest that feeding standards based on practice in temperate climates may require adjustment when applied to animals of the same type under tropical conditions.

Weaners are usually fed 3 times per day; when they are from 3 to 4 months old feeding may be reduced to twice daily, although the animals will thrive better if the thrice-daily system is continued. In either case the hours of feeding should be regular.

Cleanliness both of utensils used for mixing foodstuffs and of the feeding troughs is necessary to prevent fermentation and souring of food.

Fresh water for drinking purposes should always be available for the animals, the drinking troughs being cleaned and refilled daily.

The mixed food should be moistened with water before feeding. As far as the writer is aware, dry feeding has not been practised in Malaya. Soaking of the concentrates in this manner is considered preferable to boiling them with water before feeding. Cooking increases palatability, but is reported to lower digestibility. Recent experiments have indicated, however, that the cooking of vegetable foods does not lower the biological value of the contained proteins.(7)

In the case of whole or broken grains, grinding of the material to a fine meal followed by soaking with water as described above is considered preferable to feeding the cooked grains, even though boiling with water reduces the percentage of grains passing undigested through the animals.

Succulent fresh foods, such as sweet potato vines, tapioca leaves and roots should, however, always be boiled with water before feeding. Boiling destroys the enzyme or non-organized ferment which can break down the cyanogenetic glucoside present in the material and thus liberate hydrocyanic (prussic) acid, which is poisonous. The water in which the material is boiled should be discarded. The above precaution does not apply, however, to young Guinea grass which should be fed in a raw, chopped condition with a view to ensuring an adequate supply of those vitamins destroyed by heat. Further reference will be made to these points.

Observations on Foodstuffs Used in Rations.

In Malaya, tapioca is the most economical crop to grow in connexion with pig keeping, since both the fresh leaves and roots of the plants may be used. The roots are particularly valuable since they can provide practically all the carbohydrate (starch) content of the ration for animals other than young ones.

The refuse from a tapioca factory, which is known as *hampas*, can be substituted for fresh roots in the ration in the proportion of 4.5 lbs. of *hampas* for 2.5 lbs. of fresh root.

Tapioca factory owners frequently keep pigs, while the fresh *hampas* is often transported up to a distance of 100 miles from the factory for use by pig-keepers, so greatly is the material valued.

Drying of the *hampas* is not practised in Malaya, so that in those parts of the country remote from tapioca factories fresh roots are fed to the animals. This involves the lifting of plants every few days owing to deterioration of fresh roots if stored.

Although fresh roots of 'sweet' varieties* of tapioca may be fed in the raw stage if the roots are first peeled, boiling of the sliced material in all cases is considered preferable([8]). Further, peeling is a tedious operation and scarcely practicable.

Tapioca plants are ready for harvesting when about 12 months old, but to ensure an adequate supply of fresh roots daily, harvesting of the plants must be extended over a period from 12 to 18 months after planting. Advantage must also be taken of both recognized planting seasons March / April and October / November to establish the requisite areas to enable continuous harvesting to be carried out.

If high-yielding 'sweet' varieties of tapioca are planted, the pig manure produced returned to the soil, and a short term legume, such as cow pea (*Vigna Catjang*) or horse gram (*Dolichos biflorus*) introduced as a rotation, yields of 10 tons of root per acre per crop should be maintained.([9])

Assuming the above conditions, an area of approximately 12 acres divided into four sub-areas of 3 acres each should supply sufficient fresh root to provide the carbohydrate (starch) portion of the ration to maintain 1 boar, 10 sows and their progeny until the latter attain the usual live-weight of 140 to 180 lbs. before slaughter.

The above estimate also assumes that each sow raises an average of 7 pigs every 6 to 7 months; also that in the case of all animals over 4 months old balanced rations are fed which include fresh roots to the maximum amounts permissible.

With regard to the area under cultivation, three of the four sub-areas would always be occupied by tapioca, the fourth by the leguminous crop. If continuous cropping of tapioca is being practised the area under cultivation can be reduced to 9 acres, divided into three sub-areas of 3 acres each. A short term legume rotation is, however, recommended.

Sweet potatoes can be substituted for fresh tapioca roots, although the usual practice is to cultivate this crop for the sake of its foliage, which is used as a fresh food in the ration.

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* *Note.* 'Sweet' varieties of tapioca are those which contain a lower proportion of cyanogenetic glucoside in the flesh than in the rind. In the 'bitter' varieties the cyanogenetic glucoside is evenly distributed throughout the root.

Cropping of the vines is carried out at intervals of 1 month to 6 weeks and liberal applications of liquid (pig) manure are made after each cutting to induce fresh growth. Attention has been drawn previously to the necessity for cooking the foliage before feeding.

Guinea grass should be cut at intervals of 2 to 3 weeks; at this stage the crude fibre content of the grass is relatively low and the crude protein content high As mentioned previously the grass is chopped finely and fed in the raw state.

The consumers' market for meat in Malaya deals almost exclusively with fresh pork; the requisite firmness and percentage of carcase fat to lean is not, therefore, of the same importance as in those countries where bacon and hams are cured. For this reason, greater amounts of fat or oil can be included in local rations than are allowed, for instance, in Kellner's standard rations([5]), provided the food is not so oily as to cause nausea or to impair the appetite.

This has been confirmed both by experiments at Serdang using excess of oil supplied as copra and by pig-keepers using a large proportion of fresh rubber seeds in the ration. In both cases the pigs continued to make good live-weight increases. Further, the brittle shell of the rubber seed did not apparently injure the digestive organs of the animals.

Soya bean cake may be substituted for groundnut cake. At present owing to the disturbed conditions of trade in the Far East this cake is not available in Malaya.

Red palm oil, *i.e.* the liquid fraction of the whole oil, is included in the ration to ensure adequate supplies of the precursor of vitamin A.

It has gradually become the practice to add to the ration approximately 2 per cent. by weight of raw minerals based on the 'dry' weight of the total ration.

Recently in some circles in England there has been a reversal of opinion from complex to simple mineral mixtures, the latter comprising calcium phosphate (derived from bones), ground limestone or powdered chalk, and common salt. If white fish meal is included in the ration, only a supplement of ground limestone or powdered chalk is required.

As far as Malaya is concerned, there are indications that such simple mineral mixtures still leave deficiencies, which are manifested by pigs gnawing the timber or concrete of their styes, or showing undue activity in rooting up the ground in their exercise yards and eating earth. The mineral most likely to be deficient in Malayan foodstuffs is calcium, and the calcium-phosphorus ratio is liable to be unbalanced unless additional calcium in the form of powdered chalk or ground limestone is added to the ration. Ground limestone is now available locally.

Complete mineral mixtures are on sale at reasonable prices by local firms. A suitable home-made mixture is shown below.

There is a diversity of opinion whether potassium iodide should be included in the mixture as a source of supply of iodine. If sea salt is used in compounding, the addition of iodide is unnecessary.

	Parts by weight.
Common salt	20
Steamed bone flour	30
Wood ash	13
Ground limestone	30
Iron (ferric) oxide	2
Flowers of sulphur	5
	100

Small quantities of charcoal made from soft wood are relished by pigs. This is regarded as an aid in digestion, although on the other hand an abnormal appetite for this material may be a sign of a mineral or other deficiency in the ration.

Housing.

Elaborate and expensive houses are not necessary in the warm climate of Malaya, provided the animals have a dry bed. Pigs, like other live-stock, are susceptible to chills and rheumatism if housed in damp quarters.

Normally pigs are not dirty in their habits. Sufficient space must, however, be provided for free movement, otherwise the animals will foul their beds. Daily cleaning of the styes will encourage clean habits.

Temporary sheds are not recommended as they are difficult to keep clean, although such houses are often necessary owing to lack of capital. Houses should be well ventilated, drains should be of concrete and feed troughs of concrete or iron, while the materials for walls should be such that they do not harbour parasites. Galvanized iron sheets or hardwood planks are suitable for this purpose. Floors may be of concrete or slatted timber.

Concrete floors require to be constructed on a moderate incline and grooved to conduct urine and water to the drains.

All styes need to be periodically lime-washed, the addition of bleaching powder (hypochlorite of lime) to the lime-wash will help in the destruction of parasites.

The Asiatic pig-keeper, particularly in the flat coastal districts, lays down wooden slatted floors in his pig styes. There is no doubt that this type of floor, if substantially built, has many advantages over other forms of construction. Ventilation through the styes is facilitated, keeping them cool and, despite the Chinese custom of throwing water over the pigs in the stye several times per day, the floors soon dry. Moreover in contrast to concrete floors they are not cold to lie upon and are less liable to cause chills.

The slats are usually constructed from split trunks of the nibong palm (*Oncosperma tigillaria*) laid with the round side upwards. Hardwood slats 3 to 4 ins. in width with the upper surface rounded are also suitable. The slats must be firmly fastened $\frac{1}{4}$ to $\frac{1}{2}$ in. apart to joists having the upper surface bevelled between the slats to prevent faeces and urine lodging on the joists between the slats.

If the pigs are infested with worms, eggs are continually being passed out in the urine and/or dung; these are washed through the slats and recontamination is avoided.

This may account for the low degree of infestation by internal parasites of pigs reared on slatted floors.

Exercise Yards and Baths.

According to the observations of the Veterinary Department, Selangor, the incidence of internal parasites in pigs in Malaya is higher in European breeds and their cross-breds than in the pure-bred Chinese animals. This might be expected since it is usual for the indigenous animals to be more resistant to endemic diseases and parasites than introduced types.

To control the ingestion of the eggs of parasitic worms necessitates the supply of clean water and the maintenance of animals in confined pens having concrete or slatted floors, which can be washed clean daily. If open exercise yards are used they should have concrete floors exposed to the full sun; earth floors are dangerous since they provide a suitable environment for hatching the eggs of parasites and the development of larvae.

Whether the pig-keeper is a small-holder with a few pigs or a farmer with a large herd, attention to cleanliness is equally important, even though it may be maintained by less elaborate methods in one case than in the other.

As far as infection by internal parasites is concerned, the system of providing cheap shelters and permitting the animals to forage in open fields is not considered as safe as the use of concrete or slatted floors in confined spaces. This question will be referred to later when discussing preventive methods for internal parasites.

Water Supply.

An adequate supply of water is necessary for drinking, mixing food, cleaning and bathing purposes. In the tropics shallow baths constructed of concrete in a stream of water to which the pigs may be driven daily are much appreciated by the animals; alternatively it is advisable to wash the pigs daily by throwing water over them by means of a bucket or a hose.

It is recommended that where practicable the piggery should be built with a gravitational supply of water, and the drainage from the styes arranged so as to irrigate and fertilize land at a lower level used for the growth of crops to feed the animals. It should be noted that crops so fertilized must be boiled before feeding to the animals to ensure that any parasites have been destroyed. Guinea grass should not be so fertilized as it is essential to feed it in a raw state. Where pumping is necessary and conditions are suitable, a hydraulic ram is the cheapest pump to install since operating costs are practically negligible.

Diseases.

In general, imported pigs suffer less from tropical diseases than other introduced farm live-stock, and swine of European breeds appear more suited to a tropical

climate than European cattle. Cases of sun-scorch amongst white pigs of English breeds have never been observed at Serdang, but it must be recorded that the animals have always access to roofed styes. With regard to the infestation by internal parasites, it appears that pigs of English breeds and their cross-breds are more susceptible than are animals of pure Chinese descent and further the same degree of infestation is thought to cause greater injury to English and cross-bred pigs.

Swine are more difficult to treat when ill than other live-stock, since they are liable to suffocation when liquid medicines are being administered, owing to squealing and the danger of the medicine passing into the lungs. Medicines are, therefore, preferably administered in powder form mixed with the food; this is not always practicable, especially in cases of acute sickness, when the animals refuse to take food.(10)

The following notes on some of the more important diseases of swine, with the exception of *Stephanurus dentatus*, Deising, the kidney worm, have been abstracted from Bulletin No. 1 of the Ministry of Agriculture and Fisheries, London, entitled "Some Diseases of Farm Animals," August, 1936.(11)

Swine Fever.

Swine fever or hog cholera is a very contagious disease attacking only the pig. Young animals appear less resistant to the disease than those that are mature. A period of about 5 days, possibly more, elapses after infection and before the onset of the symptoms of the disease.

All discharges from the bodies of infected pigs contain the virus or infective agent, and healthy pigs acquire the disease by mixing with infected ones. The virus can be transmitted by itinerant castrators or on the clothes or boots of attendants or visitors; in fact itinerant boars and their attendants are very likely agents in Malaya in disseminating this disease.

Symptoms.—The affected animals refuse to take food, they shiver and sometimes vomit, their temperature rises to 104° to 107°F. A purple rash often appears on the ears, belly and hocks; diarrhoea is usually present. The animals become weak and if made to move they stagger about; finally they become unconscious and die. Great thirst and a morbid appetite are symptoms in animals that do not succumb to the acute form, but suffer from a chronic form of the disease. Swelling of the joints often takes place and the victims often show distress in the form of panting and breathlessness with pneumonia.

Swine fever may be suspected when (a) a number of pigs are dying, (b) a number of pigs are unthrifty or sick, (c) large numbers of young animals are dying, particularly if pneumonia, diarrhoea, and the apparent symptoms of swine erysipelas are present.

Post Mortem Appearances.—Purple patches are often present on the skin, the lymphatic glands may be red, while the mucous membranes lining the intestines show varying degrees of inflammation with innumerable red blood spots. Animals succumbing to a chronic form of the disease sometimes have a yellowish mucous membrane lining the intestines, while the examination in addition often reveals congestion of the lungs.

The most typical symptom is the swine fever button ulcer, which is most commonly observed in the large bowel. Ulcers also occur occasionally on the skin, tongue and in the throat. The characteristic ulcer is about half an inch in diameter, yellow or black in colour with raised outer edges.

Preventive Measures. If swine fever is present in the country either in an endemic or epizootic form, all recently purchased or introduced pigs, including animals that have temporarily been off the premises for any purpose, should be quarantined for about a month before they are mixed with the remainder of the herd.

Outbreaks of swine fever must be reported to the nearest Veterinary Officer or to the Police.

Swine Erysipelas.

This disease, which rarely occurs in Malaya, is contagious and spread by the bacillus of swine erysipelas. It does not normally attack other farm animals, but human beings are liable to become affected. It is often confused with swine fever. The usual method of spread is by manure; the bacillus can survive in the soil for a long time and pigs usually contract the disease by taking contaminated food and water. The bacilli may also gain an entrance to the body through cuts and abrasions of the skin.

Symptoms.—The affected pigs are dull with little appetite; they may be constipated with a pronounced thirst. A characteristic skin eruption develops usually on the chest, back, neck, and on the outside of the thighs. The skin in these places is discoloured, dark red or violet in sharply defined patches, which may be circular, but often quadrangular in shape, and measure 1 to 2 ins. across. The above symptoms often subside with the appearance of the skin eruption and recovery takes place after about a week to 10 days. Sometimes areas of skin peel off with sloughing of the ear tips and the end of the tail. In acute cases vomiting and constipation followed by diarrhoea may be noticeable with a rise in temperature and rapid breathing; ultimately the temperature falls and death may take place after 1 to 4 days.

Swine that have passed through the acute stage may be unthrifty and lame for a considerable period.

Post Mortem Appearances.—In acute cases, the internal lining of the stomach and bowels is inflamed; the characteristic ulcer of swine fever is, however, absent. The lymphatic glands are swollen and the spleen is often enlarged; the lungs are congested with symptoms of pleurisy.

Preventive Measures.—All newly introduced pigs should be quarantined for a few days. Carcases of pigs that have died of the disease should be buried in lime. The walls, floors, feeding troughs and utensils used, with all litter and manure from the styes, should be disinfected with a 1 per cent. solution of copper sulphate or other strong disinfectant. The administration of drugs has little effect on the course of the disease. Temporary immunity can be obtained by inoculation with

a serum (not yet available in Malaya), which also has a curative effect on infected pigs. Inoculation can be rendered more effective if the serum is administered simultaneously with the correct dose of swine erysipelas bacilli.

Anthrax.

Anthrax is a contagious disease caused by the bacterium *Bacillus anthraces*. It is usually fatal within a period of 48 hours after the animals show symptoms of illness. The disease may affect human beings and all animals.

Symptoms.—Affected animals are depressed and show a rise in temperature. They usually separate themselves from the herd and refuse food; rigours pass over the body and swelling of the throat may be noticeable. Blood may be present in the faeces or trickle from the nose; these symptoms are usually followed very quickly by death.

Anthrax usually manifests its presence by the death of the subject, and may be confused with poisoning. It is inadvisable to make a post mortem of an animal that has died having the above symptoms since it is very dangerous to the operator and the bacilli become disseminated.

Should the carcase be opened, the muscles may be observed to be infiltrated with blood. The most usual symptom of the disease is an enlarged spleen having an internal substance resembling tar. There are, however, exceptions when the spleen appears to be normal; only after microscopical examination of the blood for the bacillus can a definite diagnosis be made.

Precautions.—An animal with the above symptoms should not be killed but should be isolated. All excretions and blood should be destroyed by burning or immersion in a strong solution of carbolic acid; the blood contains bacilli from which very resistant spores form; these spores retain their viability for years and are liable to cause subsequent outbreaks of the disease. All openings of the carcase should be plugged with cloth or dried grass saturated with a strong solution of disinfectant. The carcase should if possible be burned or buried in lime in a situation to which farm animals do not have access.

Worms Infecting Intestines, Kidneys and Lungs.

The symptoms are general debility, purging and failure to make normal live-weight gains. Worms may be observed in the faeces; microscopic examination of the faeces and/or urine will reveal eggs of the parasites. Lung worms cause coughing.

Intestinal worms may be removed by appropriate doses of santonin, calomel and Epsom salts, but rigid attention to sanitation and the provision of an unpolluted water supply are in general the most important methods of combating these parasites.

The most serious worm affecting swine in Malaya is probably *Stephanurus dentatus*, Deising, the kidney worm, a parasite of warm climates, which apparently attacks European pigs and their cross-breds more severely than pure Chinese pigs. ([12] & [13]).

The eggs are voided in the urine and under warm, damp, shaded conditions they hatch in 1 to 2 days. The larvae under suitable conditions develop for a period of 4 to 6 days, when they become infective. They usually gain an entry into the body through the mouth, but they can penetrate the skin. Their usual route is up the bile duct into the liver; they then pass through the tissues of this organ into the abdominal cavity, penetrating all the tissues therein. Some reach the kidneys, and eggs laid in parts of this organ are expelled in the urine.

The worms produce unthriftiness by injuring the abdominal organs, particularly the liver, causing the development of cysts. Occasionally they induce paralysis of the hind quarters; sometimes they penetrate and puncture the main abdominal arteries and veins, resulting in the death of the animal by internal haemmorhage and peritonitis.

Treatment.—There is no known remedy for the removal of the worms from blood vessels, liver, kidney, lungs, liver muscles and abdominal organs.

Chinese pig keepers, however, have a firm belief that cooked banana stems as part of the ration possess curative properties or at least ameliorate the effect of the worm on infested pigs.

Control must be based on preventive measures. Animals should be housed on concrete or well-constructed slatted floors of hardwood so that the urine containing the voided eggs may drain away and the larvae cannot be reingested. All outside exercise yards require to be of smooth finished concrete with grooves to prevent slipping and constructed with a moderate degree of slope to facilitate drainage and rapid drying. A 10 per cent. solution of copper sulphate sprayed once every 3 or 4 days on concrete floors will destroy eggs and larvae before they can reinfest the animals. In a trial at Serdang, pigs bred from heavily infested parents were reared free of the parasite by spraying the concrete floor of the stye with a 10 per cent. solution of copper sulphate every third day until the litter was weaned. The weaners were then removed to an open pen to which pigs had not had access for several years. When the animals were slaughtered at 10½ months of age the carcases were pronounced by the veterinary officer at the abattoirs to be free of the parasite.

Restricted exercise yards with earth floors, particularly if shaded and damp, provide ideal conditions for the hatching of the eggs and the development of the larvae. Desiccation by direct sunshine on bare dry ground or concrete is one of the best known agencies for destroying the parasite.

Large exercise yards, if properly drained, free from wallows and unshaded by trees, are less dangerous. Since pigs usually urinate after feeding, water and feeding troughs should be placed on concrete floors having surrounding drains, or alternatively, they should be placed on bare unshaded ground and moved frequently so that pigs loitering in the vicinity of the troughs are not exposed to concentrations of parasitic larvae.

Infected areas should be left free of swine for at least 6 months to ensure that the parasite has died out; about 6 months elapse from the first ingestion of larvae to the excretion of eggs. It will be realized that the breeding animals in a piggery are most likely to disseminate the parasite. Fatteners infested when very young, under a system of modern intensive feeding should be approaching slaughter weights when they commence to void eggs.

Miscellaneous Worm Diseases.

There are several species of worms found in the alimentary canal of swine. One of the most common is the large round worm of the family Ascaridae which is frequently observed in faeces and also in the intestines of slaughtered pigs. These worms, which are white in colour when mature, are approximately 12 ins. long and about $\frac{1}{4}$ in. in thickness, tapering towards each end.

The eggs of the parasite are passed out in the faeces in large numbers. After some development of the embryo within the egg, which takes from 4 to 8 weeks, the swallowing of such eggs in food or water causes them to be hatched within the intestines. They pass through the tissues, including the lungs, and later pass up the wind pipe and are swallowed a second time to mature in the intestines. The females commence to lay eggs about 10 weeks after the second entry to the intestines.

The eggs are remarkably resistant to strong disinfectants, acids, or lime.

Treatment.—Young pigs suffer more from the effects of worms than older animals. Care should be taken to protect animals from birth by clearing the sow as far as possible of mature worms by doses of chenopodium oil or santonin and calomel as indicated below. The farrowing and weaner pens should be thoroughly cleaned with boiling water and washing soda.

Manure should be stacked and allowed to ferment to kill the eggs and larvae. It is advisable to place the outside layers of an old manure heap towards the centre of a fresh heap of manure. Fresh manure must not be used on land on which pigs graze, nor should it be used to grow succulent foodstuffs for feeding to pigs unless such crops are boiled before use, since soil adhering to the harvested crop is likely to contain eggs of the parasites.

Moderate doses of santonin, calomel and chenopodium oil for intestinal worms are as follows:—

Santonin and Calomel.

8 to 10 weeks old pigs	—	4 grains santonin with 6 grains calomel.
Mature pigs	—	7 grains of santonin with 12 grains calomel.

Chenopodium Oil (administered as 5 per cent. mixture with castor oil).

8 weeks old pigs	—	10 minims.
3 months old pigs	—	15 ,,
Mature pigs	—	30 ,,

Acknowledgment.

The writer wishes to express his appreciation of the valuable assistance rendered by Mr. N. Kanagaratnam, Stock Farm Assistant, in the supervision of experiments, observations on Chinese practice, and various suggestions in the writing of this article.

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Received for publication 15th December, 1939.

TUNG OIL ON CAMERON HIGHLANDS

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Introductory.

An account was given in a previous number of this Journal(1) of trials carried out at the Experiment Station, Kuala Lumpur, and the Central Experiment Station, Serdang, with *Aleurites Fordii* and *A. montana*, from the seeds of which tung oil or Chinese wood oil is obtained.

The results showed that neither of these two species of Aleurites was suited for cultivation on the lowlands in Malaya. It was thought that better results might be obtained at the Tanah Rata Agricultural Station, Cameron Highlands, situated at an elevation of about 5,000 ft., and the present article summarizes the results of the trials at that Station to date.

Cultivation of *Aleurites Fordii.*

In 1931, an area of 3 acres on a hillside of a moderate to steep slope was planted with seedlings of this species. The seedlings were spaced 20 ft. x 20 ft.

Growth has been extremely poor and no crop of fruit has been harvested.

It is obvious, therefore, that this tree is unsuited to local conditions both on the plains and in the highlands.

Cultivation of *Aleurites montana.*

In view of the poor results obtained with *A. Fordii* 1 acre of the area under cultivation was cut out during the early part of 1933 and replanted with *A. montana* seedlings at the same spacing.

Towards the end of 1933, in view of promising developments, a manurial dressing of $\frac{1}{2}$ lb. of a mixture of equal parts of calcium cynamide and basic slag was applied to each seedling tree.

Growth with this species has been considerably better than with *A. Fordii*. Many of the trees, especially those on the lower, more sheltered and possibly more fertile slopes of the hillside, have after 6 years reached a height of 12 to 15 ft. These better developed trees have a broad dense canopy and a radial branch spread of about 9 ft.

The trees first commenced to flower when about 3 years old. Since that time flowering has occurred each year at frequent intervals, and on occasions profusely. There is no definite season for flowering, which may occur during any month of the year.

A very fair proportion of the flowers appear to set, but the fruit is not always carried on the tree until full maturity. It is liable to be shed while still green at varying stages of development. Trees are often to be seen carrying both flowers and partly mature fruit.

As in the case of flowering, the trees do not exhibit any seasonal behaviour in respect of wintering. This has been recorded as occurring in all months from April to November inclusive. Wintering may occur when the trees are bearing both flowers and fruits.

Even though the trees are now nearly 7 years old no substantial crop of nuts has yet been harvested. During 1938 a yield of 38 lbs. of air-dry nuts was recorded, while that for the first seven months of 1939 was 32 lbs.

Oil Content of Seed of *Aleurites montana*.

Table I shows the results of analysis of average samples of seed collected during 1937 and 1938 at Cameron Highlands. Published figures for seed from other sources are added for purposes of comparison(2).

Table I.

Results of Analysis of Seeds of *Aleurites montana*

	Cameron Highlands, Malaya		Ceylon	China
	1937	1938		
Seed	gms.	gms.	gms.	gms.
Average weight of seed ...	2.0	2.4	2.8	2.5
	per cent.	per cent.	per cent.	per cent.
Proportion of shell ...	38.3	34.5	43.8	45.7
Proportion of kernel ...	61.7	65.5	56.2	54.3
	100.0	100.0	100.0	100.0
Kernel				
Moisture ...	4.1	4.2	4.9	4.1
Oil ...	49.5	50.3	47.3	44.0
Residue (by difference)	46.4	45.5	47.8	51.9
	100.0	100.0	100.0	100.0
Oil (moisture-free basis) ...	51.6	52.6	49.8	45.9
Seed				
Oil (on whole seed) ...	30.5	32.9	26.6	23.9

A comparison of the figures shows that while the average weight of the Cameron Highlands seed is slightly less than that of seed from Ceylon and China the local seed contains a much higher percentage of kernel. This higher percentage of kernel, coupled with a slightly higher oil content, results in a much higher oil content being recorded for the local seed compared with that from the above sources.

Special Characteristic of Tung Oil.

Among the commercially important drying oils, the chief use of which is for paints and varnishes, tung oil or Chinese wood oil is unique, because the oil has the property of being more or less easily converted into a jelly or 'gel' by heat.

The constituent of the oil mainly responsible for this unique property is the glyceride of elaeostearic acid, which forms between 75 and 80 per cent. of the total glycerides of the oil.

A film of the crude oil exposed to the air has the defect of drying in a wrinkled condition, but this tendency can be reduced very considerably as a result of proper heat treatment of the oil. The importance of a knowledge of the behaviour of the oil on heating will therefore be recognized and a 'heat' test in some form or other is a feature of every standard specification for tung oil.

Briefly, a 'heat' test consists in heating the oil to a certain temperature under controlled conditions and noting the time taken for the oil to become a 'gel.'

In the case of tung oil sold in England the British Standards Institution (B.S.I.) 'heat' test is mandatory, and to pass this test the 'gel' time must not exceed 12 minutes. The present B.S.I. specification, which is entitled "Tung Oil, Type F," is based on the Chinese product, which is derived principally from *A. Fordii*. Records show that the range of B.S.I. 'heat' test values for genuine tung oil of this type is from 11.3 to 13.0 minutes, with an average of approximately 12 minutes.

In January 1930, a scheme was inaugurated whereby the Research Association of British Paint, Colour and Varnish Manufacturers became responsible for carrying out the work necessary for the fulfilment of the plans for Empire development as co-ordinated by the Tung Oil Committee of the Imperial Institute.

The Research Association has also worked out a 'heat' test, known as the P.R.S. test. In addition to the time taken to 'gelate' under conditions somewhat different from the B.S.I. specification, the test includes a determination of the amount of the 'gel' soluble in petroleum ether(2).

Analysis of Oil from *Aleurites montana* in Malaya.

A quantity of the air-dry kernels was shredded and the material pressed cold in a small laboratory hand-press. No difficulty was experienced in obtaining a satisfactory yield of oil under these conditions. The crude oil was filtered to remove traces of matter in suspension.

The filtered oil was clear, pale yellow in colour, and had only a slight odour.

The characteristics of the oil were determined. Since the figure for the 'heat' test (B.S.I.) value was in excess of the standard, the opportunity was taken to despatch a sample of the cold drawn oil to the Research Association requesting them

to check our figures for the characteristics. The two sets of figures were in good agreement except as regards the 'heat' test value in which a still higher figure was recorded. The Research Association kindly submitted our sample of oil to their own 'heat' test (P.R.S.) in addition.

The results of the examination of the oil as determined by the Research Association are shown in Table II, average figures for *A. montana* from other sources also supplied by the Research Association being added for purposes of comparison.

Table II.

Characteristics of Oil from *Aleurites montana*.

Characteristic	Present Sample	Average Figures for *A. montana*
Colour		
Lovibond cell 10 mm.		
Yellow units ...	1.75	6.7
Red units ...	0.44	0.84
Lovibond cell 1 in.		
Yellow units ...	5.6	23.6
Red units ...	1.0	1.61
Paint Research Station Scale ...	Just below 2	—
Specific gravity (15.5°C.) ...	0.9422	0.9406
do. (25°C.) ...	0.9354	0.9342
Refractive index (20°C.) ...	1.5143	1.5166
do. (25°C.) ...	1.5125	1.5143
Saponification value ...	193.7	189.1
Acid value ...	2.1	2.1
Iodine value (Wijs 1 hr.) ...	165.8	164.5
'Heat' test	mins.	mins.
B.S.I. method ...	21	15.2
P.R.S. method ...	13.5	11.6
Amount of 'gel' soluble in petroleum ether ...	per cent. 31.8	per cent. 28.6

The results indicate that while the colour of the oil is satisfactory, the 'heat' test value by either method is considerably above the average for oil obtained from this species of Aleurites. As the Director, Paint Research Station, points out in his covering letter ".....it would appear that your oil even for *A. montana* is on the low side as far as elaeostearic content is concerned, and that condition is confirmed by the low refractive index figures."

Conclusions.

The results of the trials to date indicate that *A. montana* does not grow markedly better at Cameron Highlands than at Serdang.

The irregular wintering, flowering and fruiting periods indicate that the tree is not suited to the Malayan climate, even on the highlands.

Although the yields of fruit at a comparable age are approximately 50 per cent. higher than at Serdang they are still at an uneconomic level. Thus 32 lbs. of air-dry nuts per acre correspond to a yield of about 9 lbs. of oil per acre, which would be worth about $3.50 (Straits currency), taking as a basis a pre-war London price of £115 per ton for Chinese wood oil and making an allowance of £15 for lower quality Malayan oil.

These yields are insignificant compared with those recorded in other countries for *A. Fordii*, closely allied to *A. montana*.(3) In the case of the former, 5 years old trees planted 100 per acre may produce oil at the rate of 5 lbs. per tree, equivalent to 500 lbs. of oil per acre per annum. On the above basis the value of this amount of oil would be about $195. Further, full-grown trees thinned out to 50 per acre should produce oil at the rate of 30 lbs. per tree equivalent to 1,500 lbs. of oil per acre per annum. This quantity of oil would be worth about $585.

Even if yields of fruit were considerably higher the cost of collection would always be high by reason of the irregular fruiting of the trees and the consequent necessity for frequent searching of the ground to collect the fallen fruit.

Reference to Table II shows that the average figure for the 'heat' test (B.S.I.) value of *A. montana* oil is more than 3 minutes greater than the specified time for tung oil, being 15.2 compared with a standard of 12 minutes. In view of the importance attaching to the value for this characteristic, oil from *A. montana* must be regarded, therefore, as generally of lower grade than oil from *A. Fordii*. This statement is confirmed by the Director, Paint Research Station, who points out that with a normal market Cameron Highlands oil would command a lower price than Chinese wood oil and a still lower price than *A. Fordii* oil, which is forming the bulk of the American production.

Against this he points out that the tung oil market is not likely to be normal for many years to come and although the Malayan oil is of comparatively poor quality any supplies would be eagerly bought.

It is unfortunate that the yields of fruit to date have been so disappointing, in view of the fact that the expression of a high-grade oil from the point of view of colour and acidity would be such a simple matter.

Acknowledgments.

The authors wish to acknowledge the valuable assistance of Dr. L. A. Jordan, Director, Paint Research Station, Teddington, England, both with regard to the analysis of the oil and in supplying much useful information in respect of its market possibilities. They also wish to mention Mr. Gunn Lay Teik, Chemist, who was responsible for the analytical work carried out in the Department.

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Received for publication 22nd December, 1939.

QUARTERLY REPORT ON THE MALAYAN PINEAPPLE CANNING INDUSTRY.

September to November, 1939.

Prepared by the Economics Branch of the Department of Agriculture, S.S. & F.M.S., from Reports of Field Officers.

Factories.

The total number of registered factories, including peeling sheds, remains unchanged at twenty, distributed as follows: Johore 12, Singapore 5, Selangor 3. Of the 16 factories proper all were out of production at the beginning of the September-February season, but ten were in operation by the end of November. Of these, four were in Johore, five in Singapore and one in Selangor. One of the Singapore factories was working on juice and crush only, while factory operation generally was sporadic owing to a shortage of fruit.

All of the operating factories in Johore have installed equipment for the purchase of fruit by weight under the new fresh fruit purchasing scheme described in the following section.

Prices.

Canned fruit prices in Singapore in Straits dollars per case of 48 cans of 1½ lbs each as fixed by the Central Board were increased during the season under review as follows:—

	General Average Quality (G.A.Q.)	Golden.
Sliced Flat	from $3.20 to $4.80	from $3.60 to $5.40
,, Tall	,, 3.35 ,, 4.95	,, 3.75 ,, 5.55
Cubes	,, 3.25 ,, 4.85	,, 3.65 ,, 5.45

These increases have been necessitated in part by the increased cost of fresh fruit, sugar and tinplate.

Pending the general adoption of the new scale of prices described later, fresh-fruit prices exhibited considerable variation during the quarter. A new system of fresh-fruit payments at factory was evolved during this period and became legally binding on members as a result of its adoption at a meeting of the Central Board's Trade Committee held at the end of November.

Under this system the prices paid for fresh fruit at the factory will vary according to the weight and quality of the fruit and are based as heretofore on the selling price of a case of 1½ lbs. squat cubes. Payment in relation to weight is based on the number of standard cans, each containing 12 ozs. of fruit, that can be packed from 100 fruits of four agreed weight classes, and by allotting a cash fruit allowance per case. Quality is judged by ripeness, awarding a premium payment proportionate to the percentage of fruit which is suitable for packing into the "Golden" grade

The scales of payment for fresh fruit at factory introduced under this system at the end of the quarter under review were as follows:—

Class of Fruit	Price per 100 Fruits less than Half-Ripe		Premium per 100 for Fruit at least Half-Ripe
	Johore & Selangor	Singapore	
	$	$	cents
Under 1½ lbs. ...	0.53	0.59 to 0.62	nil
From 1½ to 2½ lbs. ...	1.01	1.12 „ 1.17	10
„ 2½ to 3½ „ ...	1.52	1.68½ „ 1.77	20
Over 3½ lbs. ...	2.03	2.25 „ 2.37	40

Production, Sales and Stocks.

The Central Board has fixed the quota for the season September to February at 950,000 cases. Johore reports indicate that the short season harvest commenced during the latter part of October and was advancing slowly at the end of November. Fruit supplies were scarce and factory requirements were only partially satisfied. Singapore and Selangor reports confirm the temporary shortage of fruit.

Exports, with values, of Malayan pineapples from January to August were quoted in the previous report. The same data for September and October, respectively, are:—5,931 tons ($698,387) and 10,696 tons ($1,248,422).

Singapore reports estimate that factory stocks are reduced to 8,000 cases, Central Board's stocks to 13,000 cases and exporters' stocks to about 40,000 cases. Exporters are in some cases unable to meet orders for forward delivery, owing to fruit shortage in the present season. Selangor reports that factory stocks amount to some 37,224 cases.

Government Research Station and Canning Factory.

Investigations into the possibilities of using a fully automatic can closing machine in conjunction with local hand-made cans have been continued, but without success. While local cans can undoubtedly be improved, only future research will show if they can be improved sufficiently for this purpose.

Trial inspections of canned pineapples, as prescribed in the Malayan Mark Enactment, have been carried out to obtain exact working definitions for marking and grading.

Varying conditions in the cooking process are being investigated for their effect on the resulting product, with particular reference to colour changes of the fruit. Can lacquers and pineapple juice production also are under investigation.

General.

Singapore pineapple areas are now estimated at 1,900 acres only, as compared with 2,800 acres at the end of 1938, thus showing a further considerable decrease. Decreases in area under pineapples are also reported from Johore, as a result of conversion of title and rubber planting, though the extent of these has not yet been determined. On the other hand the demand for new land for development is increasing in that State.

FERTILIZER PRICES, JANUARY, 1940.

The following are the prices current for the month of January, 1940, of some of the more important fertilizers.

Product.	Analysis				Price per ton $
	Nitrogen (N)	Phosphoric Acid (P_2O_5)		Potash (K_2O)	
		Soluble	Insoluble		
Sulphate of Ammonia ...	20.6	—	—	—	86.00
Calcium Cyanamide ...	20.6	—	—	—	120.00
Muriate of Potash ...	—	—	—	50	150.00
Sulphate of Potash ...	—	—	—	48	not available
Superphosphate (concentrated) ...	—	39	—	—	120.00
Superphosphate ...	—	16-18	—	—	65.00
Basic Slag ...	—	16*	—	—	66.00
Rock Phosphate (Christmas Island) ...	—	11*	38‡	—	37 ¶
Rock Phosphate (very finely ground Gafsa) ...	—	11*	26 - 28‡	—	40.00
Lime ...	—	—	—	—	20.00

* Citric soluble. ‡ Total ¶ $35.00 per ton *ex* warehouse, Singapore.

Quotations are *ex* warehouse, Port Swettenham, Klang, Singapore and Penang with the exception of muriate of potash which is *ex* warehouse, Port Swettenham, Klang and Singapore.

Departmental.

FROM THE DISTRICTS.

December, 1939.

Compiled in the Office of the Chief Field Officer from Monthly Reports by Agricultural Officers.

The Weather.

The rainfall in December was nearly everywhere below normal. In Kedah the dry season set in early in the month instead of towards the end as normally. In some parts of Selangor continuous dry weather was experienced and the land became very dry.

Ample rain fell in Kelantan but real monsoon weather has not yet commenced. In Singapore and in the extreme south of Johore the total rainfall was well up to the average, and in Singapore on two days there was very heavy rain which caused some flooding.

Crop Reports.

Rubber.—The price of rubber remained at approximately the same level as in November. Producers continued to experience difficulty in obtaining adequate supplies of coagulants. The shortage was particularly acute in certain rural districts. As an emergency measure arrangements were made to distribute limited supplies of formic acid to small-holders through Agricultural Officers. However, at present, adequate supplies of either acetic or formic acid appear to be forthcoming and arrangements have been completed to ration supplies to all classes of rubber producers.

A large Chinese rubber manufacturing concern has recently commenced buying latex from small-holders in Johore. This new and simple method of disposing of their rubber is proving attractive to many small-holders. The shortage of coagulants has given a decided fillip to the business and several new collecting stations have been opened recently.

With rubber at its present price it does not seem likely that small-holders will wish to do much replanting. In Perak a considerable area of replanting and new planting has now been completed. Budwood of approved clones is available at reasonably cheap prices from local estates and small-holders are using this budwood on their holdings. A number of small-holders in Parit district have bought budded stumps with the intention of raising their own budwood.

Titles to land recently alienated in Johore for rubber planting have contained special conditions with regard to the use of cover crops and the construction of earthworks for the prevention of soil erosion. Agricultural Officers have assisted land owners in complying with these conditions and it is reported that in the majority of cases instructions are satisfactorily carried out.

Padi.—The early commencement of dry weather in Kedah may cause some decrease in yield. Much of the crop is ripening and it is feared that the too early drying out of the land will affect the swelling of the ears of padi. On the other hand cultivators whose crops have reached the reaping stage are finding this weather ideal for harvesting.

It is expected that the crop in Krian will be at least as heavy as last year. In Pahang cultivators are very pleased with the appearance of the crops and harvesting is being carried out in fine dry weather. It is reported from Negri Sembilan that dry weather during the growing season will cause some reduction in crop in certain areas.

Panchang Bedena is still suffering badly from lack of water. The season is now so far advanced that it is doubtful whether those areas which are still dry will be planted at all this season. Many cultivators in an endeavour to obtain a crop are resowing their nurseries with short term padi. Similarly, in Malacca the crop has suffered severely from prolonged dry weather and only a very poor crop can be expected in many parts of the Settlement.

The first batch of colonists from Province Wellesley who are going to settle in the new Sungei Manik padi area are to set out early in January. Local Malay officials in the Province, who have already visited the area, have assisted in obtaining settlers, and at meetings organized in different parts of the Settlement they addressed the people.

In some of the large padi-growing areas it is always necessary to employ outside labour to harvest the crop. In Krian large numbers of Tamil labourers enter the padi areas to assist at harvest time. In North Kedah in past years labour for this work has been obtained from Patani and South Siam (immigration formalities being waived for a specified period during the harvest). In recent years less of this immigrant labour has been available and with the increase in the area planted with padi a distinct labour shortage has arisen. The crop in Central Kedah is harvested some months later than that in North Kedah so that men from the Kuala Muda District are accustomed to go up to assist in North Kedah before returning to reap their own padi.

To facilitate the flow of labour in Kedah to places where it is most urgently needed a sort of "hiring fair" has been instituted. All penghulus in the north have been asked to state their requirements. These requirements are listed by the Department of Agriculture, and by an arrangement with the District Officer, Kuala Muda, all men from Central Kedah in search of employment are instructed to foregather at the weekly fair ground, Alor Star, on given dates. Those penghulus in search of labour then visit the fair and pick their men. Up to the present, employment for 239 men has been found in this way and the method is being continued.

Coconuts.—The higher prices obtained for copra in November, which owners of coconut holdings were hoping to be the beginning of a return to prosperity, have not held, and present prices are nearly as low as those ruling prior to the outbreak of war.

Tobacco.—As a result of the war, supplies of imported cigarettes and tobacco have increased in price and also they are not always so readily obtainable as before. This has considerably stimulated the growing of tobacco locally. The price of cured leaf has everywhere increased.

Telok Chengai Padi Experiment Station.

Harvesting commenced at the end of December. Much attention has been given to the roguing of impurities. A few cases in which "red" forms have appeared in "white" varieties (differing only in the colour of the glumes) have been preserved for trial next year. Such forms have been found in Siam 29, Reyong 20, and Subang Intan. It is not known if they are hybrids, mutants, or due to segregation after some earlier crossing.

DEPARTMENTAL NOTES.

Appointments.

Major C. D. V. Georgi, O.B.E., Senior Chemist and Acting Chief Research Officer, has been appointed to be Chief Research Officer, S.S. and F.M.S., with effect from the 1st January, 1939.

Mr. T. D. Marsh, Agriculturist and Acting Senior Agriculturist, has been appointed to be Senior Agriculturist with effect from the 8th November, 1939.

Mr. G. Griffith arrived in Malaya on the 8th December, 1939, on transfer from Uganda Protectorate and assumed duty as Chemist (Soils) with effect from the 9th December.

Leave.

Mr. B. A. Lowe, Agricultural Officer, returned from leave on the 14th December, 1939, and resumed duty as Agricultural Officer, Cameron Highlands, with effect from the 15th December.

Mr. C. L. Newman, Agricultural Officer, returned from leave on the 29th December, 1939. Mr. Newman has been seconded to the Sarawak Government for service in the Sarawak Agricultural Department.

Mr. R. B. Jagoe, Botanist, has been granted 156 days leave from 11th January to 14th June, 1940, inclusive.

Statistical.

MARKET PRICES.

December 1939.

Major Crops.

Rubber.—Prices continued at a high level, with a certain amount of fluctuation. No. 1. X. Ribbed Smoked Sheet opened in Singapore at 39¼ cents per lb., and after rising to 40¼ cents on the 14th December weakened to close at 37⅞ cents.

The average of daily quotations for the month was 38.91 cents per lb., as compared with 39.02 cents in November. The London average price was 11.57 pence per lb., and New York 19.81 cents gold, as compared with 11.25 pence and 20.01 cents gold respectively in November.

Prices paid for small-holders' rubber at three centres during the month are given in Table I.

Table I.

Weekly Prices Paid by Local Dealers for Small-Holders' Rubber, December, 1939.

(Dollars per picul of 133 1/3 lbs.)

Grades	Kuala Kangsar, Perak	Kuala Pilah, Negri Sembilan		Batu Pahat, Johore.		
	20	7	14	13	20	27
Smoked sheet ...	47.64	45.68	48.60	—	48.00	—
Unsmoked sheet ...	—	—	—	46.70	46.50	44.33
Scrap ...	—	—	—	—	—	—

Transport by F.M.S.R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8 per ton.

Transport from Batu Pahat to Singapore by lorry, excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

No purchases of rubber at Kuala Kangsar on the 6th, 13th and 27th December, at Batu Pahat on the 6th, and at Kuala Pilah on the 21st and 28th December.

Palm Oil.—According to *The Oil and Colour Trades Journal,* 1st December, 1939, the prices of palm oil in the United Kingdom were unchanged in the new list of prices for materials allocated to trade consumers, announced by the Ministry of Food for the period 26th November to 31st December 1939. The prices, per ton, were as follows:—

£17.15s.	c.i.f. in casks to be returned.
£17. 5	c.i.f. in loan drums.
£16. 5	c.i.f. in bulk.
£27.	refined deodorized, naked *ex* works.
£31.	refined hardened deodorized, naked, *ex* works, (not previously quoted).

Local sales of palm oil, 5 per cent. f.f.a., in selling drums, were made in December at $180 per ton f.o.b. Singapore and Port Swettenham.

Copra.—Prices were high at the beginning of the month but fell later. The sun-dried grade opened in Singapore at $5 per picul, but commenced to weaken on the 8th December and closed at $3.80. The Singapore average price for the month was $4.42 per picul as compared with $3.89 in November. The mixed grade was quoted at 35 cents per picul lower than the sun-dried grade.

Rice.—The Singapore average wholesale prices of rice per picul in October 1939 were as follows:—Siam No. 2 Ordinary $4.15, Rangoon No. 1 $4.35, Saigon No. 1 $3.65, as compared with $4.12, $4.12 and $3.72 in September 1939, and with $4.47, $3.70 and $4.07 in October 1938.

The October average retail prices in cents per gantang (gallon) of No. 2 Siam rice were:—Singapore 30, Penang 30, Malacca 30, as compared with 29, 30 and 30 in September.

The average declared trade value of imports during October was $3.89 per picul, as compared with $3.81 in September and $3.54 in August.

Padi.—The Government Rice Mills, Perak and Pahang, continued to pay $2.20 per picul for padi, and, in the case of the Perak mills, a bonus of 10 cents per picul for pure strain S.K. 48 padi.

Retail prices of padi per 100 gantangs (gallons) were as follows:—Province Wellesley and Penang $9.10; Selangor $11 to $14; Pahang $10 to $13 (Temerloh $8.50 to $10, Bentong $12 to $13); Negri Sembilan $8 to $12 (Seremban and Coast $14 to $15); Kelantan $10.50; Labuan $12; Brunei $10 to $14 (Belait $18 to $20).

Pineapples.—There was no change during December in the prices of canned pineapples as fixed by the Central Board of Packers. They were as follows, per case of 48 cans of 1½ lbs. each:—G.A.Q.: Sliced Flat $4.80, Sliced Tall $4.95, Cubes $4.85; Golden: $5.40, $5.55 and $5.45.

The Central Board has fixed prices to be paid for fresh fruit according to the following table.

Class of Fruit	Average Weight of 100 Fruit	Price for every 100 Fruit less than Half-Ripe			Premium for every 100 Fruit at least Half-Ripe
		Johore & Klang	Singapore		
			Kranji	Serangoon Grove Road	
	lbs.	$	$	$	cents
Under 1½ lbs. ...	125	0.53	0.59	0.62	nil
1½ lbs. to 2½ lbs. ...	200	1.01	1.12	1.17	10
2½ lbs. to 3½ lbs. ...	300	1.52	1.68½	1.77	20
Over 3½ lbs. ...	400	2.03	2.25	2.37	40

Beverages.

Tea.—No London prices are available.

The latest Colombo prices available, quoted from *The Ceylon Tea Market Report* of 19th December, 1939, of the Colombo Brokers' Association, are as follows, in rupee cents per lb.:—High Grown Rs. 1.07, Medium Grown 94, Low Grown 90.

Coffee.—Liberian coffee was quoted throughout the month in Singapore at $16 per picul. Excelsa weakened from $14.50 to $14, and Robusta opened at $8, fell to $7.50 and closed at $8.

The average of highest and lowest quotations in Singapore for Palembang coffee was $13.06 to $14.37, and for Sourabaya coffee $15.12 to $17.38. The November averages were $11.20 to $13.15 and $13.60 to $15.80.

Spices.

Arecanuts.—The averages of the Singapore Chamber of Commerce quotations per picul, which were stated to be nominal and approximate, were:—Best $6.70, Medium $6.45, Mixed $6.05.

The averages of the highest and lowest quotations per picul in Singapore were as follows:—Splits $4.87 to $7.12, Red Whole $5.06 to $7.25, Sliced $10.25 to $13.75, as compared with $11.10 to $13.20, $5.15 to $7, and $4.95 to $7.17 in November.

Pepper.—Singapore Black averaged $8.65 per picul; the market for Singapore White was stated to be nominal only; Muntok White averaged $16.40 per picul. The November averages were $8.19, $14.66 and $15.88 respectively.

Nutmegs.—110's rose to $40 per picul, but closed at $38, averaging $38, while 80's rose to $42, closed at $41, and averaged $41.40. The November average prices were $32 and $40 per picul respectively.

Penang dried nutmegs were sold at $20 per picul.

Mace.—The market continued a nominal one, with no quotations available. Locally produced mace, dry, was sold in Penang at $80 per picul.

Cloves.—A nominal market and no quotations available. Penang cloves, dried, sold in Penang at $62.50 per picul.

Cardamoms.—Green cardamoms were quoted in *The Ceylon Chamber of Commerce Weekly Report* of 18th December 1939, from Rs. 1.48 to Rs. 1.65 per lb.

Miscellaneous.

Derris.—Although 'panic buying' appears to have come to an end, the covering of overdue contracts prevented prices from easing, and prices actually were higher.

Average prices per picul for December were as follows:—$11 to $12 for roots sold on a basis of ether extract; $23 to $25 for roots sold on rotenone content. The November averages were $10 to $11 and $22 to $24 per picul respectively.

Gambier.—The market for Block was a nominal one with no quotations. Cube No. 1 improved from $14 to $15, averaging $14.60 per picul, as compared with $16.25 in November.

Sago.—Pearl opened in Singapore at $11.50 per picul, falling to $10.50, with an average for the month of $10.95. Flour, Sarawak Fair, rose from $7 to $7.75, averaging $7.30 per picul. The November average prices were $9.12 and $6.06 respectively.

Tapioca.—Flake Fair improved from $10 to $11, averaging $10.40 per picul, as compared with $9.12 in November. Seed Pearl and Medium Pearl were quoted throughout the month at $11.25 per picul. The November average price for both grades was $9.50.

Tobacco.—Prices of prepared tobacco in Kelantan per picul were: 1st quality $100 to $170, 2nd quality $70 to $135, 3rd quality $55 to $115. In Johore dried leaf sold at $12.50 to $44, and prepared tobacco from $36 to $144. Prices of dried leaf elsewhere were: Province Wellesley and Penang 1st quality $31.60, 2nd quality $22.50, 3rd quality $11; Pahang $20 to $37, $10 to $30, $5 to $25; Negri Sembilan $26 to $28, $16 to $22 (Jelebu $12 to $18), $15 to $20 (Jelebu $6 to $9).

The above prices are based on London and Singapore daily quotations for rubber, on the Singapore daily prices for copra, on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports and certain coffee prices are kindly supplied by Guthrie & Co. Ltd., Kuala Lumpur, local palm oil prices by Whittall & Co., Kuala Lumpur, the Singapore prices of imported coffee and arecanuts by Lianqui Trading Company of Singapore, and Singapore derris prices by Hooglandt & Co., Singapore.

1 picul = 133 1/3 lbs. The dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Trafalgar Square, London, W.C.2.

MALAYAN AGRICULTURAL EXPORTS, OCTOBER, 1939.

PRODUCT	Net Exports in Tons				
	Year 1938	Jan./Oct. 1938	Jan./Oct. 1939	October 1938	October 1939
Arecanuts ...	33,769	28,268	33,122	342	2,325
Coconuts fresh††‡ ...	116,743†	88,612†	82,705†	11,705†	9,580†
Coconut oil‡ ...	49,140	38,791	50,107	5,217	5,135
Copra‡ ...	68,754	50,589	42,139	12,710	3,334
Copra cake ...	7,112	5,369	7,644	365	291
Gambier, all kinds ...	1,632	1,332	1,301	123	104
Palm kernels ...	9,359	7,269	8,338	977	1,111
Palm oil ...	54,377	47,018	49,078	5,019	7,120
Pineapples, canned ...	73,168	64,609	76,924	4,622	10,696
Rubber¶ ...	360,898¶	335,658¶	296,076¶	24,238¶	42,283¶
Sago,—flour ...	4,537	3,625	7,856	229	3,189
,, —pearl ...	4,203	3,567	3,142	386	267
,, —raw ...	5,088*	4,330*	4,246*	310*	478*
Tapioca,—flake ...	981	791	856	104	77
,, —flour ...	3,072*	2,623*	1,995*	233*	143*
,, —pearl ...	17,818	15,079	15,191	1,638	1,228
Derris ...	676	494	1,037	87	125
‡Copra equivalent ...	150,944	115,416	125,217	21,421	11,869

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS

(In long tons, as declared by Estates).

Month 1939	Palm Oil			Palm Kernels		
	F.M.S.	U.M.S.	Malaya	F.M.S.	U.M.S.	Malaya
January ...	2,402.5	2,726.3	5,128.8	429.7	502.0	931.7
February ...	2,193.4	1,693.3	3,886.7	372.9	282.0	654.9
March ...	2,453.1	2,324.8	4,777.9	437.9	394.0	831.9
April ...	2,160.5	2,082.2	4,242.7	423.4	346.0	769.4
May ...	2,066.0	1,760.1	3,826.1	403.1	274.1	677.2
June ...	2,204.8	2,030.2	4,235.0	368.9	318.0	686.9
July ...	2,522.8	2,360.9	4,883.7	437.0	353.0	790.0
August ...	3,613.2	3,004.2	6,617.4	680.8	554.0	1,234.8
September ...	3,260.9	1,625.8	4,886.7	651.2	276.0	927.2
October ...	2,624.5	2,062.2	4,686.7	552.4	326.0	878.4
November	2,397.1	2,608.3*	5,005.4	457.2	386.0	843.2
Total ...	27,898.8	24,278.3	52,177.1	5,214.5	4,011.1	9,225.6
Total January to November, 1938	26,689.9	19,696.0	46,385.9	4,708.3	3,198.0	7,906.3
Total for the year 1938 ...	28,979.0	22,087.7	51,066.7	5,158.9	3,620.0	8,778.9

Stocks on estates as at 30th November, 1939, were: palm oil 2,114 tons, palm kernels 1,753 tons.

* Includes 202.9 tons due to incorrect returns for January to October, 1939, from an estate

STATE OR TERRITORY	Estimated Acreages of Tappable Rubber (9)+(11)	ACREAGES OF TAPPABLE RUBBER NOT TAPPED				Area of tappable rubber never been tapped (b)		Total area not tapped (3) + (5) (c)		TOTAL AREA TAPPED DURING THE MONTH		Area of tappable rubber rested under rotational systems (c)	
		On estates which have entirely ceased tapping		On estates which have partly ceased tapping (a)									
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)	Acreage	Percentage of (9) to (2)	Average	Percentage of (11) to (2)	Acreage	Percentage of (13) to (2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
S. S.—													
Province Wellesley ...	42,939	369	0.9	10,233	23.8	507	1.2	10,602	24.7	32,337	75.3	8,417	19.6
Malacca ..	117,540	1,754	1.5	23,676	20.1	1,815	1.5	25,430	21.6	92,110	78.4	25,950	22.1
Penang ..	2,549	nil	nil	1,037	40.7	35	1.4	1,037	40.7	1,512	59.3	60	2.4
Singapore ..	31,797	4,622	14.5	7,421	23.4	275	0.9	12,043	37.9	19,754	62.1	3,360	10.6
Total S.S. ...	194,825	6,745	3.5	42,367	21.7	2,632	1.4	49,112	25.2	145,713	74.8	37,787	19.4
F. M. S.—													
Perak ...	283,441	7,402	2.6	47,393	16.7	6,399	2.3	54,795	19.3	228,646	80.7	44,000	15.5
Selangor ...	314,472	4,444	1.4	43,966	14.0	5,961	1.9	48,410	15.4	266,062	84.6	50,019	15.9
Negri Sembilan ...	261,282	7,877	3.0	52,411	20.1	10,839	4.1	60,288	23.1	200,994	76.9	38,202	14.6
Pahang ...	84,929	1,503	1.8	17,940	21.1	4,503	5.3	19,443	22.9	65,486	77.1	8,659	10.2
Total F.M.S. ...	944,124	21,226	2.3	161,710	17.1	27,702	2.9	182,936	19.4	761,188	80.6	140,880	14.9
U. M. S.—													
Johore ...	477,553	11,264	2.4	103,655	21.7	33,136	6.9	114,919	24.1	362,634	75.9	60,877	12.7
Kedah ...	198,600	8,294	4.2	18,963	9.5	6,067	3.1	27,257	13.7	171,343	86.3	37,917	19.1
Kelantan ...	31,235	403	1.3	7,000	22.4	2,196	7.0	7,403	23.7	23,832	76.3	5,338	17.1
Trengganu (d) ...	4,817	nil	nil	40	0.8	nil	nil	40	0.8	4,777	99.2	1,868	38.8
Perlis (e) ...	1,459	335	23.0	271	18.5	147	10.1	606	41.5	853	58.5	224	15.4
Brunei ...	5,970	nil	nil	1,601	26.8	260	4.4	1,601	26.8	4,369	73.2	1,333	22.3
Total U.M.S. ...	719,634	20,296	2.8	131,530	18.3	41,806	5.8	151,826	21.1	567,808	78.9	107,557	14.9
Total MALAYA ...	1,858,583	48,267	2.6	335,607	18.1	72,140	3.9	383,874	20.7	1,474,709	79.3	286,224	15.4

Notes.—(*a*) Area out-of-tapping on estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.

(*b*) The acreage shown in column (7) is included in columns (3) and (5).

(*c*) Areas of tappable rubber rested under rotational systems are not considered as out-of-tapping and therefore columns (11) and (12) include columns (13) and (14) respectively.

(*d*) Registered companies only.

(*e*) Figures for the quarter ending 30th September, 1939.

MALAYAN RUBBER STATISTICS Table I.

ACREAGE, STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF NOVEMBER, 1939, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports during the month		Imports January to Nov. 1939		Exports including re-exports during the month		Exports including re-exports January to Nov. 1939		Stocks at end of month			Consumption 3	
	Ports	Dealers	Estates of 100 acres and over	during the month	Jan. to Nov. 1939	during the month	Jan. to Nov. 1939	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	Jan. to Nov. 1939
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	5,423	19,663	13,176	115,057	2,783	50,286	Nil	Nil	Nil	Nil	10,988	4,505	132,126	39,114	...	4,481	21,049	22	204
Johore ...	...	2,307	7,067	6,020	50,562	2,511	33,698	Nil	99	Nil	658	2,892	5,798	29,948	57,839	...	1,685	7,629	...	...
Kedah ...	...	361	4,470	3,264	28,566	771	8,781	Nil	Nil	Nil	Nil	1,438	2,389	17,007	21,335	...	224	4,815	...	...
Perlis ...	...	27	22	16	127	29	244	Nil	Nil	Nil	Nil	Nil	36	Nil	356	...	23	35	...	...
Kelantan ...	...	505	596	338	3,610	446	6,636	Nil	Nil	Nil	Nil	217	604	2,777	7,493	...	422	642	...	...
Trengganu ...	...	33	269	150	1,513	171	2,534	Nil	Nil	Nil	Nil	Nil	305	Nil	4,069	...	26	292	...	...
Brunei ...	...	14	85	56	468	74	650	...	...	...	...	...	154	...	1,143	...	9	66	...	...
Total Malay States	...	8,670	32,172	23,020	199,903	6,785	102,829	Nil	99	Nil	658	15,535	13,791	181,858	131,349	...	6,870	34,528	22	204
S. SETTLEMENTS :—																				
Malacca ...	...	1,768	1,752	1,241	10,881	538	5,917	Nil		Nil		2,917		24,935		...	1,320	1,779	...	...
Province Wellesley	...	671	951	524	4,391	187	1,841	Nil		Nil		6,387		68,639		...	443	905	...	...
Penang ...	1,562	2,144	15	21	184	78	768	1,212	14,632	25,666	130,910		Nil		Nil	682	2,194	11	...	...
Singapore ...	6,030	15,662	231	156	1,254	94	653	12,386		143,127		24,437		236,324		7,897	12,233	261	19	264
Labuan ...	...	16	Nil	Nil	Nil	9	108	59		579		Nil		Nil		...	16	Nil	...	...
Total Straits Settlements ...	7,592	20,279	2,949	1,942	16,710	906	9,287	13,657	14,632	169,372	130,910	33,741	Nil	329,898	Nil	8,579	16,206	2,956	19	264
Total Malaya ...	7,592	28,949	35,121	24,962	216,613	7,691	112,116	13,657	14,731	169,372	131,568	49,276	13,791	511,756	131,349	8,579	23,076	37,484	41	468

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	3,793	11,376	1,990	1,594	1,430	128
WET RUBBER	688	857	204	194	255	96
TOTAL ...	4,481	12,233	2,194	1,788	1,685	224

TABLE III
FOREIGN EXPORTS

PORTS	For month	Jan. to Nov. 1939
29	30	31
Singapore ...	36,480	355,757
Penang ...	9,090	105,249
Port Swettenham.	3,582	49,682
Malacca ...	124	1,068
MALAYA ...	49,276	511,756

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	Jan. to Nov. 1939
32	33	34
Malay States ...	29,183	312,379
Straits Settlements	2,962	25,681
MALAYA ...	32,145	338,060

Notes:—

1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Columns (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S and F.M.S., at Singapore on 23rd December, 1939

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine.		
	Means of			Absolute Extremes						Total.		Most in a day.	Number of days.					Total.	Daily Mean.	Per cent.
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hrs.	hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	89.7	72.6	81.1	95	70	85	75	83.6	84.3	4.44	112.8	0.67	18	16	4	3	—	181.35	6.05	50
Bukit Jeram, Selangor† ...																				
Port Swettenham, Selangor	88.7	72.5	80.6	92	69	82	75	84.6	85.1	7.51	190.8	2.40	19	19	1	—	—	202.20	6.74	56
Sitiawan, Perak ...	88.1	73.3	80.7	91	71	82	76	83.8	84.5	3.29	83.6	0.60	17	12	—	—	—	170.80	5.69	48
Ipoh Aerodrome, Perak ...	88.9	72.7	80.8	92	70	82	74	82.8	84.0	8.53	216.7	1.94	19	17	2	1	—	171.85	5.73	48
Temerloh, Pahang ...	88.5	72.5	80.5	92	69	82	75	84.7	86.1	10.89	276.6	3.22	21	18	5	9	—	158.15	5.27	44
Kuala Lipis, Pahang ...	88.9	71.7	80.3	93	68	84	75	82.4	84.2	10.20	259.1	1.39	22	20	7	28	—	172.85	5.76	48
Kuala Pahang, Pahang ...	86.0	73.9	79.9	90	71	81	76	83.5	85.6	10.17	258.3	2.18	18	16	—	—	1	170.00	5.67	47
Kallang Aerodrome, S'pore ...	85.4	75.3	80.3	89	73	78	78	82.3	83.5	9.47	240.5	2.26	15	12	4	—	—	151.85	5.06	42
Bayan Lepas Aerodrome Penang ...	85.4	73.9	79.7	89	72	81	77	83.2	84.0	13.93	353.8	2.49	23	18	3	—	—	163.15	5.44	46
Malacca Town, Malacca ...	85.0	73.9	79.5	87	71	81	79	83.2	84.1	6.44	163.6	1.64	18	14	2	1	3	195.50	6.52	54
Kluang, Johore ...	88.4	71.7	80.1	91	70	78	74	82.2	82.5	7.23	183.6	1.16	16	16	7	9	—	164.20	5.47	45
Mersing, Johore ...	86.7	72.6	79.7	92	71	81	75	82.4	82.7	5.80	147.3	1.12	21	18	3	—	—	168.55	5.62	47
Alor Star, Kedah ...	86.5	73.4	79.9	91	70	81	76	84.3	85.2	16.73	424.9	2.72	26	22	3	1	—	145.90	4.86	41
Kota Bahru, Kelantan ...	85.9	73.5	79.7	92	71	78	75	82.9	84.6	16.73	424.9	3.03	19	18	1	—	—	123.65	4.12	35
Kuala Trengganu, Trengganu	85.3	72.9	79.1	88	70	80	75	82.0	84.3	9.26	235.2	2.38	19	16	—	—	—	138.90	4.63	39
Labuan ...	86.3	76.2	81.3	89	73	79	80	84.1	85.5	14.70	373.4	3.13	20	18	2	—	—	223.10	7.44	63
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	73.1	62.1	67.6	79	60	69	64	72.0	72.5	9.95	252.7	1.63	25	20	4	6	2	125.70	4.19	35
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	71.8	58.0	64.9	76	53	69	62	70.7	70.1	12.23	310.6	2.15	24	22	—	6	1	118.15	3.94	33
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.2	59.5	65.3	76	57	67	62	*	*	12.37	314.2	2.24	24	21	—	—	1	120.25	4.01	34

* Not recorded.

† Station closed on 15th August, 1939.